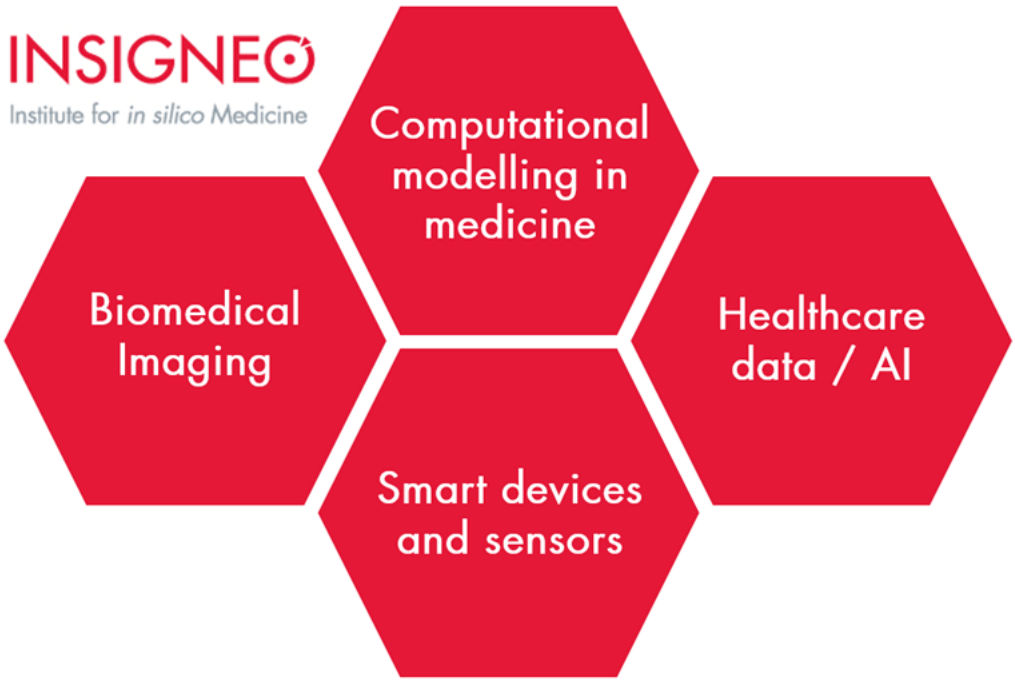
INSIGNEO Institute for *in silico* Medicine | The University Of Sheffield. | Sheffield Teaching Hospitals NHS Foundation Trust

Insigneo Newsletter - June 2021

Welcome to our monthly Insigneo newsletter!

Our monthly e-newsletter keeps you up to date with events, funding, success stories and information. We hope you will find it useful! If you would like to add information and/or events to this newsletter please email: news@insigneo.org (the newsletter will be issued during the 2nd week of the month, excluding January and August). Please ensure that you submit news and events with a minimum of one week's notice.

Insigneo research theme workshop



The next step in taking forward the Insigneo Institute's vision, scope and strategy is to develop working groups in the research themes identified above. A research theme workshop will be held online on **Tuesday 29th June** (Insigneo members check your diaries).

ESPRC New Investigator Award for Dr Pinaki

Bhattacharya

Congratulations to Insigneo Member Dr Pinaki Bhattacharya, Lecturer in Solid Biomechanics at the University of Sheffield's Department of Mechanical Engineering, on his £354k EPSRC New Investigator Award.

Dr Bhattacharya's research on Stochastic finite element (FE) of Bone Mechanics will aim to develop a computational framework that can predict effect sizes on bone mechanics in preclinical studies for new candidate drugs for the treatment of osteoporosis. It is expected that over the next 10 years, the number of people in the UK with osteoporosis (currently, 3 million) and the annual costs to NHS for treating osteoporotic fractures (currently, £4 billion) will increase by up to 30%. Dr Bhattacharya's innovative approach could dramatically reduce the cost and time involved in drug development.

Read more

Professor Visakan Kadirkamanathan appointed as the new Chair of the United Kingdom Automatic Control Council

Congratulations to Insigneo Member Professor Visakan Kadirkamanathan who has been appointed as the new Chair of the United Kingdom Automatic Control Council (UKACC), taking over from the outgoing Chair, Professor Roger Dixon.

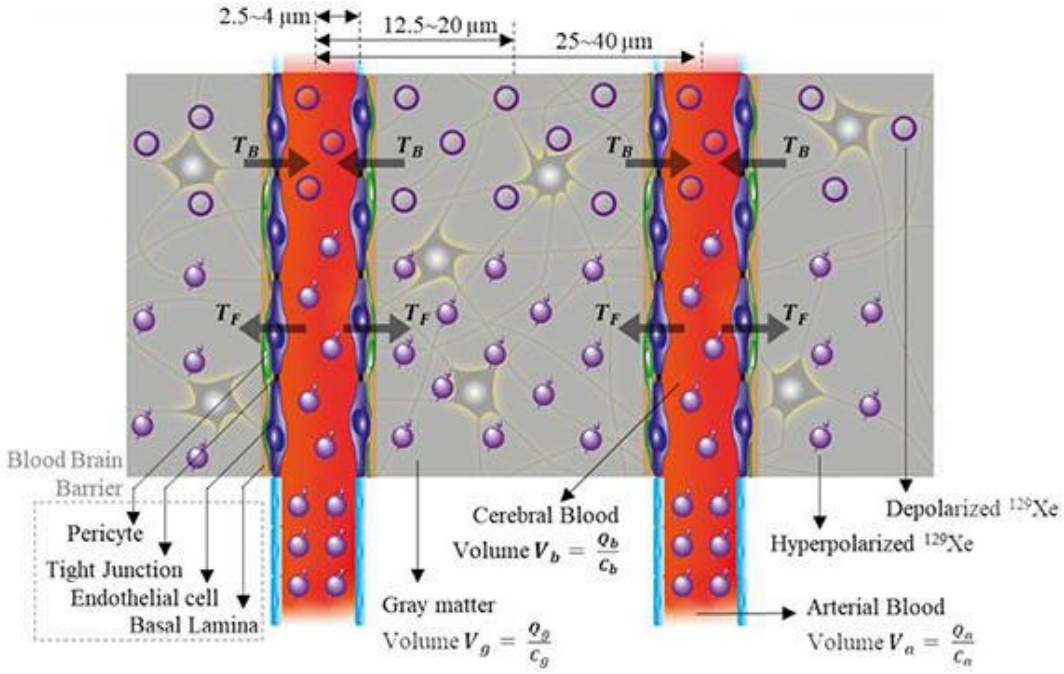
UKACC is the UK's member organisation of the International Federation of Automatic Control (IFAC) and seeks to act as an effective link between the UK and the international control communities.

The wider purpose of the IFAC is to promote the science and technology of control in the broadest sense, in all systems (including engineering, physical, biological and economic) and is also concerned with the impact of control technology on society.

This is achieved through Technical Committees, Conferences, Symposia and Workshops as well as the annual UKACC Lecture and the biennial Control Conference.

Professor Kadirkamanathan is looking forward to working with UKACC membership and the IFAC to promote the interests of the wider control and systems engineering community in the UK.

'Measuring 129Xe transfer across the blood brain barrier using magnetic resonance spectroscopy' selected as MRM Editor's top pick for June 2021



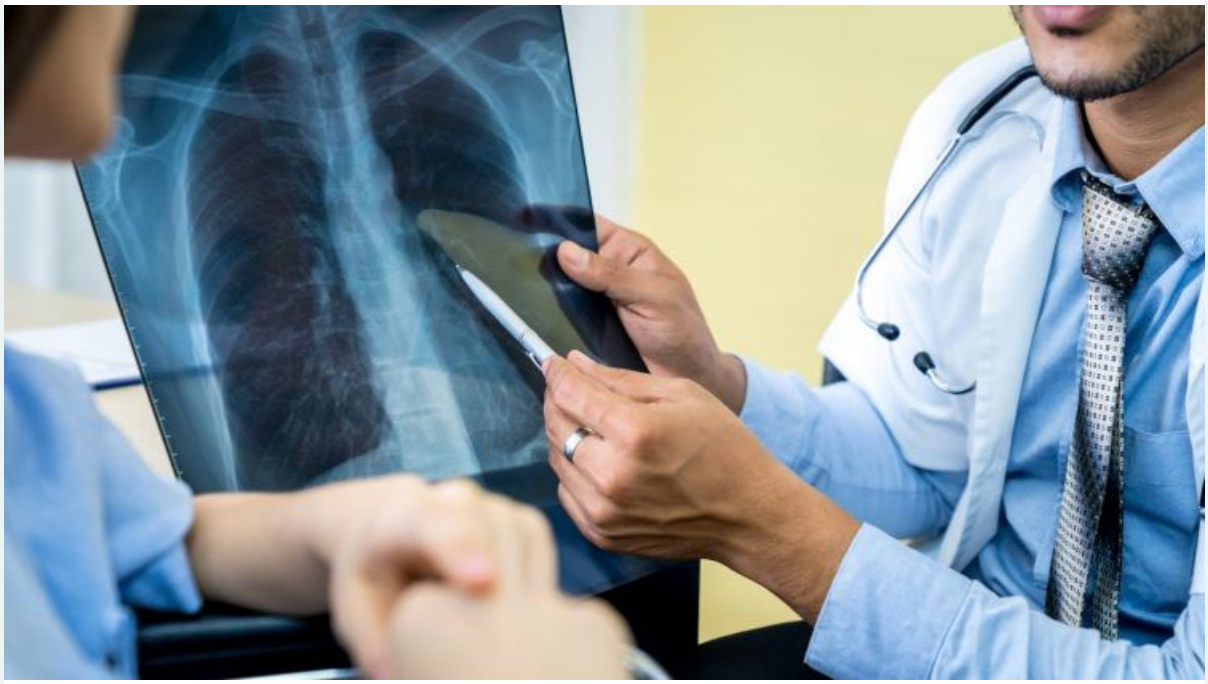
Congratulations to Insigneo Member Madhwesha Rao and colleagues from the Polaris research group at the University of Sheffield's Department for Infection, Immunity & Cardiovascular Disease who paper 'Measuring 129Xe transfer across the blood brain barrier using magnetic resonance spectroscopy' has been selected as Magnetic Resonance in Medicine (MRM) Editor's top pick for June 2021.

In this study the researhers developed a tracer kinetic model for time□resolved NMR spectra of HP 129Xe in the human brain to estimate the transfer rate of HP 129Xe from cerebral blood to gray matter that depends on a tracer transfer constant

for a known mean transit time and cerebral blood volume for gray matter.

Read more

Study confirms longer-term lung damage after COVID-19

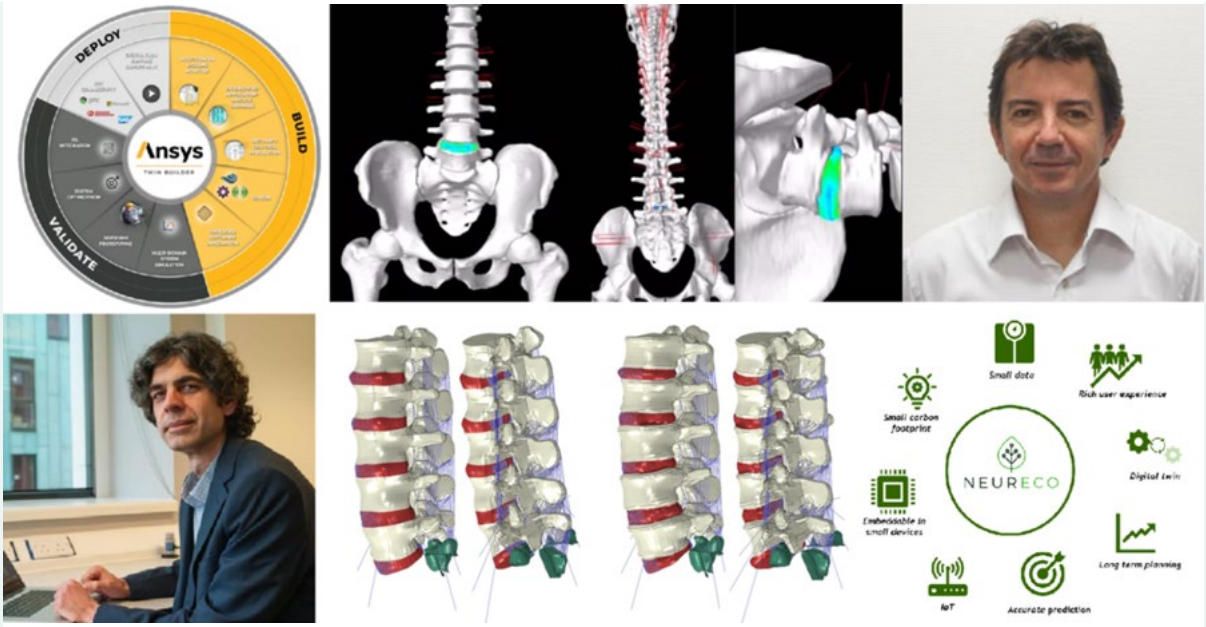


A study by Sheffield and Oxford researchers using a cutting-edge method of imaging has identified persistent damage to the lungs of COVID-19 patients at least three months after they were discharged from hospital, and for some patients even longer.

- Hyperpolarised xenon MRI detected lung damage which was not picked up by routine CT scans and clinical tests
- The cutting-edge method of imaging pioneered at the University of Sheffield has identified persistent damage to the lungs of Covid-19 patients at least three months after they were discharged from hospital

Read more

Spinner's third training event



At the end of April, Spinner held its third training event. In response to the current travel restrictions this was held online, over five mornings. The focus of the training was modelling and simulation and involved:

- An introduction to the parsimonious approach to deep learning by Adagos, illustrated with a workshop using their NeurEco neural network package.
- An introduction to reduced order modelling by Ansys, illustrated with a workshop using their Twin Builder.
- Lectures on using finite element models to simulate the spine as an aid for surgery from Marie-Line Pissonier, Hôpital Pitie Salpêtrière, Prof Yohan Payan, CNRS and Prof Damien Lacroix, University of Sheffield.

SPINNER EID is a Doctorol Training Programme funded by the European Union's Horizon 2020 researh and innovation programme under the Marie Skłodowska-Curie Actions (MSCA) Innovative Training Networks (ITN) and European Industrial Doctorate (EID).

The programme, which is coordinated by Professor Gwen Reilly, has six bioengineering early stage researchers appointed as SPINNER fellows who are being trained to design the next generation of repair materials and techniques for spine surgery.

Read more

Update on the PRIMAGE project

PRIMAGE

Medical imaging
Artificial intelligence
Childhood cancer research

As the PRIMAGE project enters its 31st month, they have shared the milestones achieved during the past months and the tasks that they expect to deliver by November 2021, leading to the final version of the PRIMAGE platform.

The EU-funded PRIMAGE project aims to develop a cloud-based platform to support decision making in the clinical management of two of the most dangerous childhood cancers: Neuroblastoma and Diffuse Intrinsic Pontine Glioma. PRIMAGE's performance will be trained and validated with thousands of real-world data from the most prominent European Paediatric oncology units, clinical trials, and European Imaging Biobanks, contributing to European shared data infrastructures.

The University of Sheffield, is responsible for developing a cellular level agent-based model (ABM) of the neuoblastoma tumour microenvironment, led by Dr Dawn Walker in the Department of Computer Science, working with Insigneo PDRA, Dr Kenneth Wertheim, and collaborators at the University of Bologna to integrate this into a multiscale model from molecular to organ level and also optimising this model and deploying it in a HPC environment, led by Dr Paul Richmond in the Department of Computer Science.

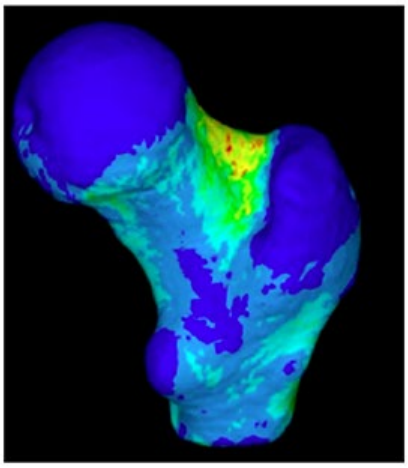
Work is ongoing in Insigneo to develop a cellular based model of neuroblastoma, that will interact with models across multiple biological scales to allow the entire tumour to be simulated under chemotherapeutic treatments".

In parallel, work has been ongoing to implement our model in a highly optimised format on GPUs, and we are excited to announce the recent release of the latest generation of the FLAMEGPU simulation environment, FLAMEGPU2.

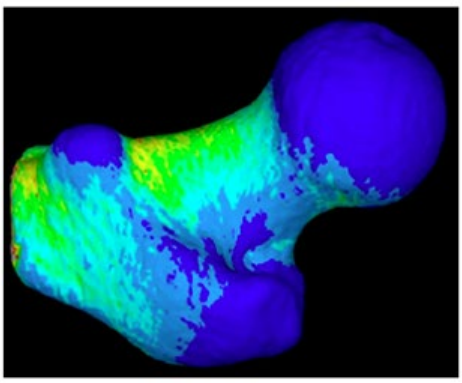
Read more

Delivering computationally-intensive digital patient applications to the clinic: An exemplar solution to predict femoral bone strength from CT data

Picture showing the location of fracture for the loading case with minimum strength.



Picture showing the location of fracture for the loading case with minimum strength.

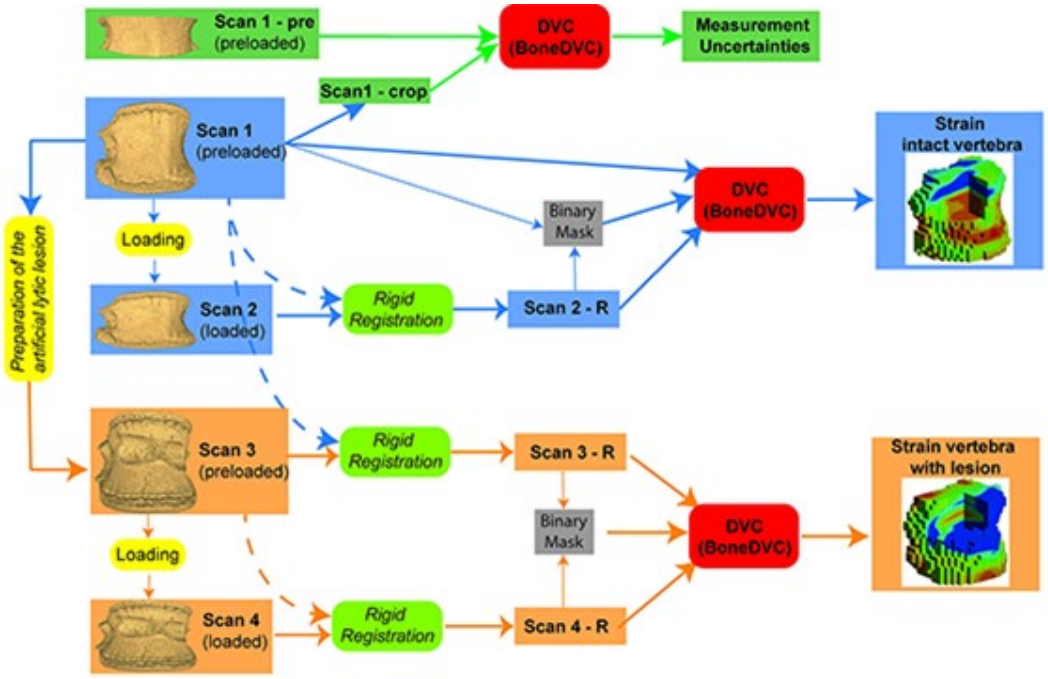


To increase the clinical uptake of FE predictive models the University of Sheffield, in collaboration with Sheffield Teaching Hospitals, has developed a service called "Computed Tomography To Strength" (CT2S). Doctors in the hospital request the analysis of a patient by accessing the website of the service. Using a combination of open source software, the website initiates a secure transfer of the medical CT images from the hospital's database to the Insigneo Institute's one. An operator then downloads and processes the images to build a personalised FE model of the patient. To estimate the strength, 28 loading simulations are performed on the local HPC cluster at The University of Sheffield. After the analysis, the results are sent to the clinician in a PDF document. The entire workflow can be executed in 3.5 hours.

CT2S is built on open source software, meaning that can be easily deployed in other institutions, thus further increasing the uptake of FE based methods for bone strength prediction.

Read more

A novel approach to evaluate the effects of artificial bone focal lesion on the three-dimensional strain distributions within the vertebral body



Evaluation of strength of the bone affected by the presence of metastases is fundamental to assess the fracture risk. This work proposes a method to evaluate the variations of strain distributions due to metastatic lesions within the vertebra.

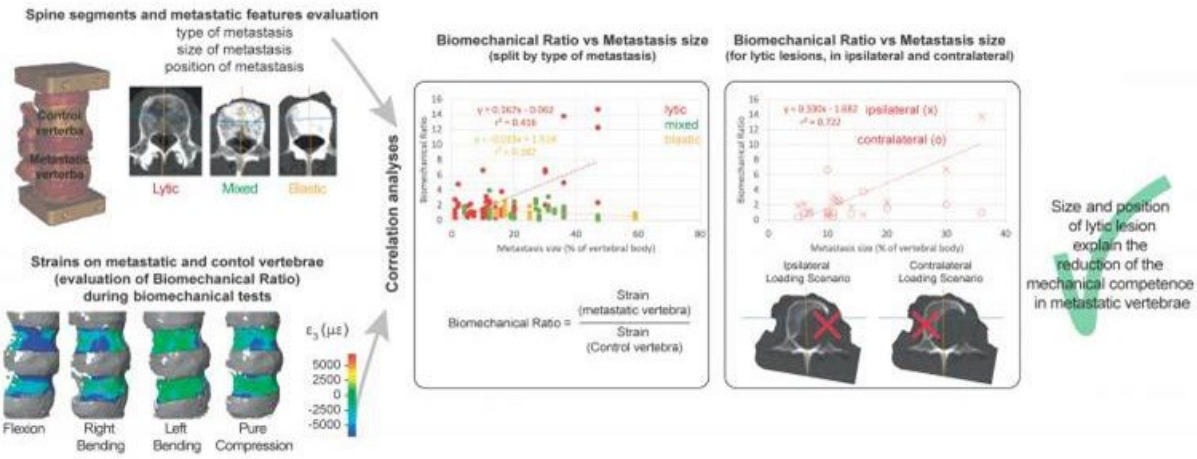
Five porcine vertebrae were tested in compression inside a micro computed tomography scanner. Principal strains were computed within the bone by means of digital volume correlation (BoneDVC).

All intact specimens showed a consistent strain distribution. The artificial lesion generally doubled the strain in the middle portion of the specimen, probably due to stress concentrations close to the defect.

In conclusion, a robust method was developed and will be used to improve clinical assessment of fracture risk in metastatic spines.

Read more

Type, size, and position of metastatic lesions explain the deformation of the vertebrae under complex loading conditions



Bone metastases may lead to spine instability and increase the risk of fracture.

A novel biomechanical approach was used to evaluate the effect of lesion type, size, and location on the mechanical competence of the metastatic vertebra.

Vertebrae with metastases were collected from a donation programme. The size and position of the metastases were evaluated. The vertebrae were tested in different loading conditions and the strain distribution was measured with Digital Image Correlation.

The metastatic type characterizes the vertebral behaviour. Once the position of the lytic lesion with respect to the loading direction was taken into account, the size of the lesion was significantly correlated with the perturbation to the strain distribution.

These results highlight the relevance of the size and location of the lytic lesion in driving the spinal biomechanical instability.

Read more

Grant writing club - 25 June 2021

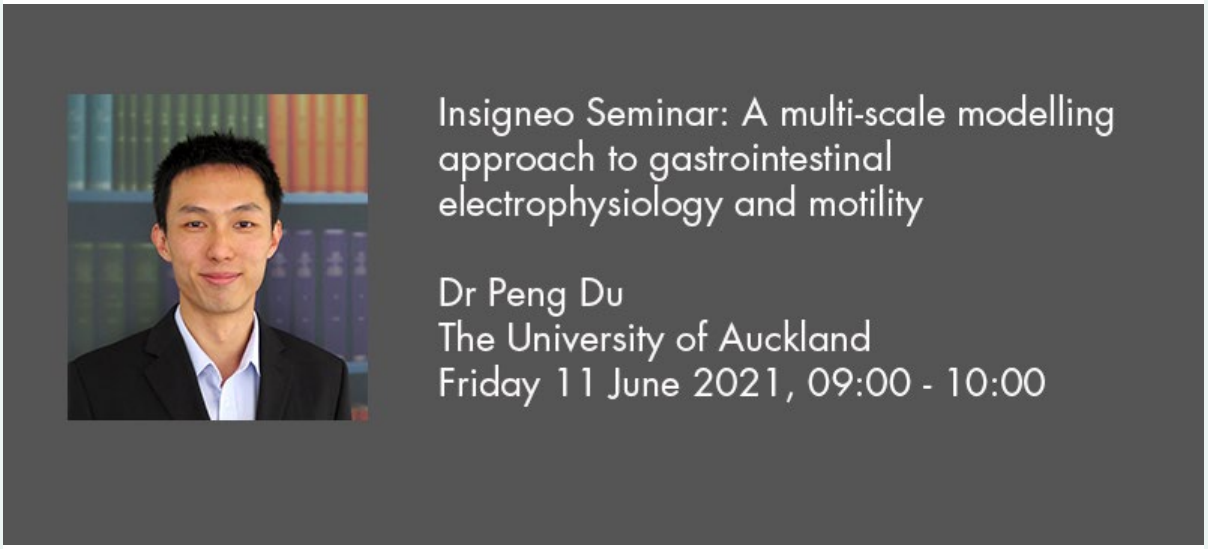
Insigneo members are invited to join the Department of Infection, Immunity & Cardiovacular Disease's weekly Department Research in Progress Meetings (DRIP) and the Imaging and Cardiovascular research themes Grant Writing Club which has been scheduled for 11:00 immediately following the 25 June DRIP meeting (please contact sarah.black@sheffield.ac.uk to arrange access to DRIP meetings).

This meeting is designed to provide PDRAs, fellows and academics with feedback on their funding applications at an early stage. This is how it works:

- grant writers submit a 1-2 page summary of their grant (or fellowship) with specific aims,
- this is circulated to other PIs/Fellows in our theme before the meeting.
- We then ask those attending the meeting to provide feedback at the meeting.

If you have an idea you would like us to consider at the meeting, please send Professor Paul Evans (paul.evans@sheffield.ac.uk) a 1-2 page summary of your proposal including your aims, the funding scheme, and approximate funding/costs.

Insigneo seminar: Multiscale modelling of Gastrointestinal Electrophysiology by Dr Peng Du from the Auckland Bioengineering Institute



We'd like to thank Dr Peng Du for an excellent seminar and, for anyone who missed it, you can now access a recording of the session.

Watch recording

Guest Lectures, Conferences & Seminars

Insigneo events

29 June
Insigneo research theme workshop

Insigneo Seminar: Computational Design of Personalized Treatments for Movement Impairments

B.J. Fregly, Ph.D.
Professor and CPRIT Scholar in Cancer Research,
Department of Mechanical Engineering,
Rice University

Friday 9 July 2021, 15:00 - 16:30

9 July 2021
Insigneo Seminar: Computational Design of Personalized Treatments for Movement Impairments

Insigneo Seminar

Dr Diane Wagner
Department of Mechanical Engineering,
IUPUI

Friday 16 July 2021, 15:00 - 16:30

16 July 2021
Insigneo Seminar: Dr Diane Wagner (IUPUI) - topic TBC

Other events

23 June
Synopsys Simpleware Customer Webinar Computer Models in Wound Care Research: The Key to Innovation

23 June
UK BioBank Seminar - Code Set Selection Methods for Primary Care Data

24th June
nTopology, Ansys EOS, NSI, Synopsys A Journey Through Advanced Manufacturing in 2021: Part 6(/6) Expert Panel discussion of the entire workflow and implications on mass-production

25 June
10:00 IICD Department Research in Progress Meeting & Grant Writing Club
Speakers: 'Kugeln - A Novel Cerebrovascular Endothelial Membrane Behaviour in the Zebrafish and its Characterisation in the Mammalian Brain.' - Karan Govindpani, ''Inhibition of growth hormone signalling in autosomal dominant polycystic kidney disease' - Fiona Macleod. **Insigneo members contact sarah.black@sheffield.ac.uk to arrange access.**

28 June
Sano Seminar: A Bayesian Nonparametrics View into Deep Representations

28 - 30 June
BRS Annual Meeting 2021

29 June
Translating Artificial Intelligence into Clinical Practice

30 June
UK Biobank Seminar - Prediction of worldwide trait population variation

2, 9 & 16 July
Online Introductory Medical Device Regulatory training course - **open to members of University of Sheffield, Sheffield Teaching Hospital, Sheffield Hallam University and Sheffield Children's Hospital. Please contact sarah.black@sheffield.ac.uk to arrange access.**

2 July
BioMedEng Education Workshop – The Impact of COVID-19

2 July
IICD Department Research in Progress Meeting
Speakers: Treatment planning in Post Thrombotic Syndrome : insights from modelling' - Andrew Narracott, 'AI from research to practice - Clinical Validation of deep learning cardiac MRI segmentation' - Samer Alabed. **Insigneo members contact sarah.black@sheffield.ac.uk to arrange access.**

5 July
Sano Seminar: What is medical education informatics?

5 & 8 July
MultiSim2 Sandpit Event

11 -14 July
ESBiomech Conference 2021, Milan

12 July

Sano Seminar: Jacek Kitowski – Institute of Computer Science and ACC Cyfronet AGH, Krakow, Poland

12 - 14 July
N8 CIR: High Performance Computing for Healthcare

13 July
Ansys: Integrating 3D Medical Images with Simulation

16 July
IICD Department Research in Progress Meeting
Speakers: Dynamic imaging of DNA-Protein interactions using AFM' - Vinny Verma, Md Miraj Kobad Chowdhury (title TBC). **Insigneo members contact sarah.black@sheffield.ac.uk to arrange access.**

20 July
Materialise: Mimics Enlight Structural Heart Planner Workshop: Gain Firsthand 3D-CT Planning Experience: LAOO planning

25 - 29 July
ISB2021, Stockholm

19 - 23 August
International Symposium on Artificial Intelligence for Medical Applications (AI4MED)

6 - 7 September
BioMedEng21, Sheffield

6 - 10 September
Bone Cell & Tissue Mechanics Advanced Courses, CISM (International Centre for Mechanical Sciences)

6 - 10 September
VPH Institute: 2nd International School on In Silico Trials

7 - 9 September
CMBBE 2021 Symposium 17th International Symposium on Computer Methods in Biomechanics and Biomedical Engineering and the 5th Conference on Imaging and Visualization

8 - 10 September
AMMM – Additive Manufacturing Meets Medicine 2021 - **deadline for regular papers 28/06/21**

15 - 17 September
CompBioMed Conference 2021: Building the Virtual Human

3 – 28 September 2021
KKIO 2021 - prime software engineering conference - **Abstract submission deadline extended to 30 June**

22 - 27 November
Klaster LifeScience Kraków (KLSK) Life Science Open Space 2021

For a full list of upcoming events visit: http://insigneo.org/events/

Vacancies

PhD Opportunity: Detection and analysis of metastatic and primary oral cancers and stromal features with advanced deep learning (closing date: 15/07/21)

Publications

Research output affiliated to Insigneo in Scopus (please ensure papers are affiliated to the Insigneo Institute by including the words "Insigneo Institute for *in silico* Medicine"):

Mechanical Stimulation Modulates Osteocyte Regulation of Cancer Cell Phenotype (Cancers) S. W. Verbruggen, C. L. Thompson, M. P. Duffy, S. Lunetto, J. Nolan, O. M. T. Pearce, C. R. Jacobs, M. M. Knight

A novel approach to evaluate the effects of artificial bone focal lesion on the three-dimensional strain distributions within the vertebral body (PLoS ONE) M. Palanca, G. De Donno, E. Dall'Ara

Type, size, and position of metastatic lesions explain the deformation of the vertebrae under complex loading conditions (Bone) M. Palanca, G. Barbanti-Bròdano, D. Marras, M. Marciante, M. Serra, A. Gasbarrini, E. Dall'Ara, L. Cristofolini

Delivering computationally-intensive digital patient applications to the clinic: An exemplar solution to predict femoral bone strength from CT data (Computer Methods and Programs in Biomedicine) I. Benemerito, W. Griffiths, J. Allsopp, W. Furnass, P. Bhattacharya, X. Li, A. Marzo, S. Wood, M. Viceconti, A. Narracott

Disrupted osteocyte connectivity and pericellular fluid flow in bone with aging and defective TGF-β signaling (PNAS) C. A. Schurman, S. W. Verbruggen, T. Alliston

The Role of the Loading Condition in Predictions of Bone Adaptation in a Mouse Tibial Loading Model (Frontiers in Bioengineering and Biotechnology) V. San Cheong, V. Kadirkamanathan, E. Dall'Ara

Tweet

Share

Forward

Insigneo Institute
for *in silico* Medicine
F Floor- Room F19
The Pam Liversidge Building
Sir Frederick Mappin Building
The University of Sheffield
Mappin Street
Sheffield, S1 3JD

For further information and to contribute
please email news@insigneo.org